IGCSE PAST PAPER 3 EXTENDED PHYSICS 0625

WORK DONE, ENERGY TRANSFER & ENERGY

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1 **(a)** Energy from the Sun evaporates water from the sea. Some of this water eventually drives a hydroelectric power station. Give an account of the processes and energy changes involved.

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.....

.....[4]

(b) In a hydroelectric power station, 200 000 kg of water per second fall through a vertical distance of 120 m. The water passes through turbines to generate electricity, and leaves the turbines with a speed of 14 m / s.

(i) Calculate the gravitational potential energy lost by the water in 1 second. Use $g = 10\,m/s^2$.

potential energy lost = ...[2]

(ii) Calculate the kinetic energy of the water leaving the turbines in 1 second.

kinetic energy = ...[2]

2 Fig. 4.1 shows a truck lifting a heavy load.

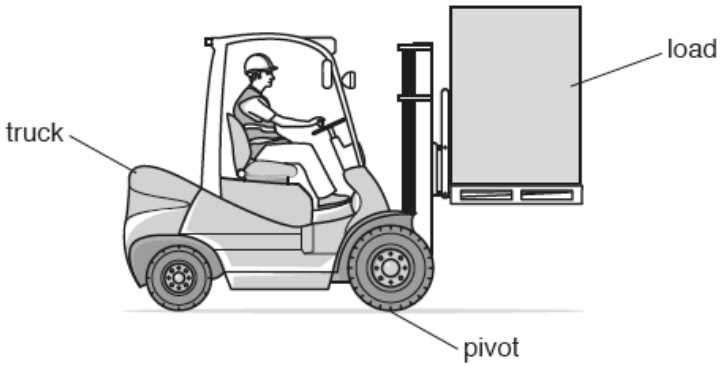

Fig. 4.1

(a) (i) The truck is stationary. Identify the quantities that determine the work done as it lifts the load.

Tick the box next to each correct quantity.

- ☐ distance
- ☐ force
- ☐ time [1]

(ii) Draw a ring around the unit for work done from the list.

joule newton pascal watt [1]

(b) Identify the quantities that determine the power of the truck.

Tick the box next to each correct quantity.

- ☐ energy transferred
- ☐ temperature
- ☐ time [1]

3 Fig. 3.1 shows a simple pendulum swinging backwards and forwards between P and Q. One complete oscillation of the pendulum is when the bob swings from P to Q and then back to P.

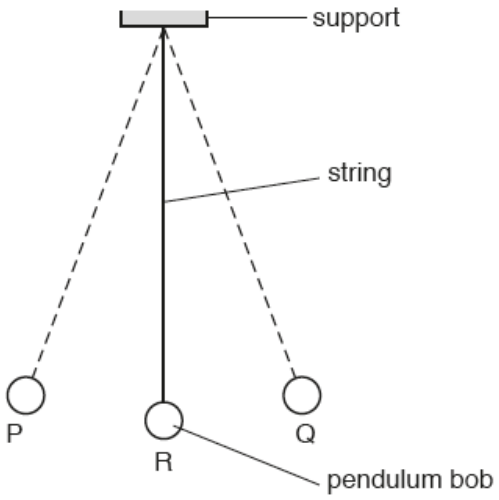

Fig. 3.1

As the pendulum bob moves from R to Q it gains 0.4 J of gravitational potential energy.

Air resistance can be ignored.

State the value of kinetic energy of the pendulum bob at

1. R ..... J

2. Q .....J [2]

4 Electrical energy from the power station is used to power two different lamps. Fig. 5.1 shows how the light outputs from two types of lamp vary with the power input.

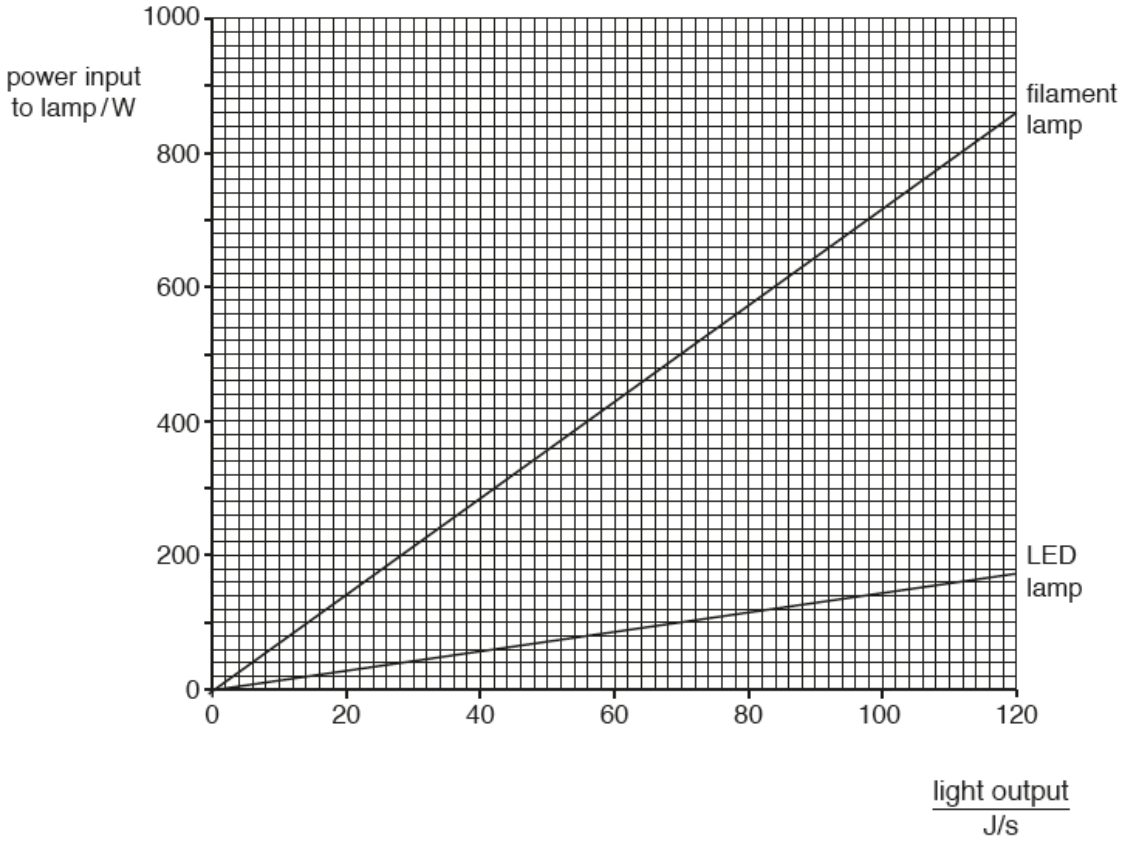

Fig. 5.1

(i) An experiment requires a lamp with a light output of 70 J/s.

For the LED lamp and for the filament lamp determine the input power required to give a light output of 70 J/s. Use information from Fig. 5.1.

1. For the LED lamp, input power = ... W

2. For the filament lamp, input power = ... W

[2]

(ii) Explain why using LED lamps is better for the environment. Use information from Fig. 5.1 in your answer.

.....

.....

.....

..... [2]

[Total: 6]

5 (a) On a day with no wind, a fountain in Switzerland propels 30 000 kg of water per minute to a height of 140 m.

Calculate the power used in raising the water.

power = ... [4]

(b) The efficiency of the pump which operates the fountain is 70%.

Calculate the power supplied to the pump.

power = ... [3]

6 When a salmon swims up a river to breed, it often has to jump up waterfalls. Fig. 3.1 shows a salmon jumping above the surface of the water. On this occasion the salmon falls back down into the river.

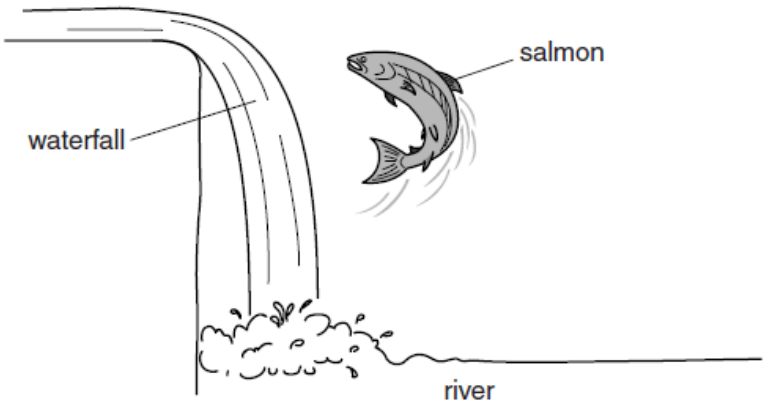

Fig. 3.1

The salmon has a mass of 2.0 kg.

(a) The salmon leaves the water vertically with a kinetic energy of 16.2 J.

(i) Calculate the speed of the salmon as it leaves the water.

speed = ... [2]

(ii) Calculate the maximum height gained by the salmon. Ignore air resistance.

gain in height = ... [3]

7 Fig. 4.1 shows a small wind-turbine used to generate electricity.

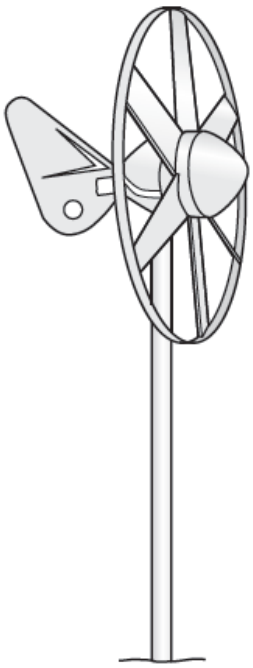

Fig. 4.1

The wind-turbine drives an electric generator.

The wind blows with a velocity of 7.0 m/s at right angles to the plane of the turbine. The mass of air passing per second through the turbine is 6.7 kg.

(a) (i) Calculate the kinetic energy of the air blown through the turbine per second.

kinetic energy = ... [2]

(ii) Only 8% of this energy is converted to electrical energy.

Calculate the power output of the electric generator.

power output = ... [2]

8 Fig. 3.1 shows a long, plastic tube, sealed at both ends. The tube contains 0.15 kg of small metal spheres.

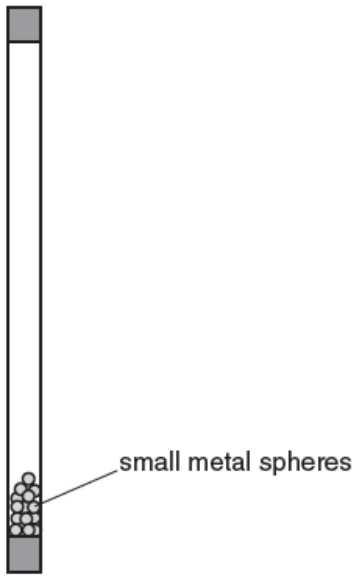

Fig. 3.1

A physics teacher turns the tube upside down very quickly and the small metal spheres then fall through 1.8 m and hit the bottom of the tube.

(a) Calculate

(i) the decrease in gravitational potential energy as the spheres fall 1.8 m,

decrease in gravitational potential energy = ... [2]

(ii) the speed of the spheres as they hit the bottom of the tube.

speed = ... [3]

9 Use words from the list below to complete the sentences about work and energy.

initial acceleration

distance moved

force exerted

potential energy

time taken

An object is dragged across a rough surface. In order to find the work done on the object, it is necessary to know the ..... and the ..... .

To calculate the power, it is also necessary to know the ..... . [3]

In Fig. 4.1, a small bird, a large bird and a squirrel are on the ground under a tree.

Fig. 4.1

A loud noise scares the two birds. They both fly up to the top of the tree.

(a) (i) Which bird does the most work raising itself to the top of the tree? ..... [1]

(ii) Explain your answer to **(a)(i)**.

..... [1]

(b) A squirrel has the same weight as the large bird. It climbs the tree, to the same height as the birds.

How does the increase in the squirrel's gravitational potential energy compare with that of each of the two birds? Answer the question by completing the sentences below.

Compared with that of the small bird, the increase of the squirrel's potential energy is ..... .

Compared with that of the large bird, the increase of the squirrel's potential energy is ..... . [2]

(c) Which creature has the least gravitational potential energy when they are at the top of the tree?

..... [1]

(d) The small bird flies back down to the ground.

What happens to the gravitational potential energy it had at the top of the tree?

..... [2]

[Total: 7]

A student wishes to work out how much power she uses to lift her body when climbing a flight of stairs.

Her body mass is 60 kg and the vertical height of the stairs is 3.0 m. She takes 12 s to walk up the stairs.

(a) Calculate

(i) the work done in raising her body mass as she climbs the stairs,

work = ... [2]

(ii) the output power she develops when raising her body mass.

power = ... [2]

(b) At the top of the stairs she has gravitational potential energy.

Describe the energy transformations taking place as she walks back down the stairs and stops at the bottom.

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..... [2]

[Total: 6]